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242. ON THE MIOCENE PECTINIDAE FROM THE ENVIRONS OF SENDAI; PART 4. *PECTEN AKITANUS* YOKOYAMA AND *CHLAMYS NISATAIENSIS* OTUKA.*

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仙台附近中新統産 Pectinidae, その 4. *Pecten akitanus* YOKOYAMA 及び *Chlamys nisataiensis* OTUKA に就いて: *Pecten akitanus* YOKOYAMA 及び *Chlamys nisataiensis* OTUKA を再検討し, 地質学的意義に就いての考察を行つた。 増田孝一郎

Introduction and Acknowledgements

Among the fossil scallops hitherto recorded from the Miocene formations developed in northeastern Japan, *Pecten akitanus* YOKOYAMA and *Chlamys nisataiensis* OTUKA are of particular interest because of their confusing characters and restricted geological range as to be discussed in the following pages.

Pecten akitanus was first described by M. YOKOYAMA in 1926 from Kurosawa in Taihei-mura, Minami-Akita-gun, a locality which is referred to Beds B of K. MURAYAMA, who collected the specimens. This species is also recorded by M. YOKOYAMA (1926) from Kinonezaka in Yazawagi-mura, Hiraga-gun, both in Akita Prefecture. Kinonezaka is referred to Beds F of K. MURAYAMA, who collected the material. Of these mentioned Beds, the first one is considered as belonging to the Wakimoto formation and the latter to the Sugota formation, being Pliocene and Miocene in age respectively.

Chlamys nisataiensis was first described by Y. OTUKA in 1934 from Nisatai in Nisatai-mura, Ninohe-gun, Iwate Prefecture, and also recorded by the same author from Tate, Shiratori and Takaba, which are three localities of the same formation and in the same Ninohe-gun. The formation from where the species was originally described was stated to be the Lower Kadonosawa Series, a name which is not appropriate from the standpoint of stratigraphical nomenclature, and was therefore renamed by K. HATAI as the Shiratori formation; this is of Miocene age.

That the characters of the above mentioned two species are confusing may be easily understood from the fact that *Chlamys nisataiensis*, although first described in 1934, was previously recorded as *Pecten akitanus* YOKOYAMA in 1933 by the same author. Similarly in the environs of Sendai, H. MATSUMOTO in 1929 recorded *Pecten akitanus* YOKOYAMA from Kumanodô in Takadate-mura, Natori-gun, which is a typical fossil locality of the Moniwa formation. However, there is no subsequent record of that species from the Moniwa formation, although S. NOMURA in 1940 re-

* Read Feb. 28, 1953; received March 27, 1953.

ported on the occurrence of *Pecten* (*Chlamys*) *nisataiensis* (OTUKA) from both Goishi and Kita-Akaishi, which are two localities of the Moniwa formation. The writer has also made extensive collections from the Moniwa formation at the above mentioned three localities and has failed to collect *Chlamys akitana*, thus suggesting that the species has either been mis-identified or is very rare.

Having studied the rich collections in the Institute of Geology and Paleontology, Tohoku University, and in the Saito Ho-on Kai Museum, both in Sendai, and also those now preserved in the Department of Geology, College of Education of the Tohoku University, the writer, herein, describes the characters of these two confusing scallops.

Acknowledgements are due to Dr. Kotora HATAI of the Department of Geology, College of Education, Tohoku University, for kindly supervising the present work. Thanks are also due to Dr. Kiyoshi ASANO of the Institute of Geology and Paleontology, Tohoku University, for his kind offer of the specimens which he collected from Kitano in Yazawagi-mura, Hiraga-gun, Akita Prefecture, a typical locality of the Sugota formation.

Family Pectinidae

Subfamily Pectininae

Genus *Chlamys* (BOLTEN) RÖDING, 1798

Chlamys akitana (YOKOYAMA), 1926

Pl. 12, Figs. 8a–b, 9a–b, 10, 11, 12a–b, 13a–b, 14, 15a–b, 16a–b, 17

1926 *Pecten akitanus* YOKOYAMA, *Jour. Fac. Sci., Imp. Univ. Tokyo, Sec. 2, vol. 9*, p. 388, pl. 44, figs. 15, 16, 17.

The original description of *Pecten akitanus* is as follows :—

" Shell small, rather thick, compressed, orbicular, somewhat higher than long, radiately ribbed.

Right valve : Ribs about twenty-five in number, flattened, usually broader than interspaces, often split into two by a groove ; ears unequal, with radiately riblets, anterior longer and larger than posterior, byssal notch triangular.

Left valve : Of about the same convexity as the right valve, ribs about twenty-five, but with an intercalarly in every interspace, occasionally splitting into two like those of the right valve ; ears unequal, with posterior larger, radiately ribbed. "

The present specimens which are typical, take the following description.

Shell small, rather thick, suborbicular, subequivalve, equilateral except for auricles and radiately ribbed. Right valve with 23–25 round-topped, radial ribs and concentric growth lines, and rarely with intercalarly threads ; finely imbricated ; radial ribs usually bifurcate at about half of disc-length and broader than the interspaces ; the bifurcated radials subequal in strength near margin. Left valve with 23–25 round-topped, radial ribs, intercalary threads and fine concentric growth lines making surface finely imbricated ; radial ribs rarely bifurcate and as wide as or narrower than the interspaces ; intercalary threads subequal in strength near margin in adult specimens. Anterior auricle of right valve larger than posterior, with distinct byssal notch, narrow byssal area and distinct ctenolium ; auricles sculptured with radial threads and concentric lines by which they appear imbricated. Auricles of left valve subequal and sculptured with distinct radial threads and concentric lines, and also

imbricated; anterior with wide and shallow byssal notch. Hinge straight, cardinal crura of right valve rather distinct, and lateral ridges of resilial pit widely open towards the lower. Internal surface rather smooth, but with marginal serration.

Remarks.—This species is characterized by the rather thick and small shell which is provided with 23–25 round-topped, dichotomizing radial ribs rarely with intercalary threads on the right valve, and by having 23–25 round-topped, rarely dichotomizing radial ribs with intercalary threads on the left valve. The right and left valves are nearly equal in convexity.

Pecten (*Chlamys*) *jordani* ARNOLD (1906, p. 114, pl. 44, figs. 1, 1a, 1b) from the Pliocene and Pleistocene formations of California, resembles *akitana* in having numerous, smooth topped, imbricated, dichotomizing radial ribs. ARNOLD's species is distinguishable from *akitana* by the larger and rather thinner shell, by being inequivalve and by the narrower and deeply channeled interspaces.

Dimensions (in mm).—

Valve	Right	Right	Right	Left	Left	Left
Height	20	18	14	32	18	25
Length	19	17	14	31	17	24
Hinge-length	10	9.5	8	15	10	11
Depth	5	4	3	9	4	6
Apical angle	90°	95°	95°	95°	90°	90°

Type locality and geological formation.—Road cliff near Kurosawa, Taihei-mura, Minami-Akita-gun, Akita Prefecture. Wakimoto formation. Pliocene. (There are no subsequent records of collections of this species from the type locality. The writer feels that Kinonezaka in Yazawagi-mura, Hiraga-gun, Akita Prefecture (Sugota formation) may be the true type locality and geological horizon of the species.)

Described specimens.—Kitano, Yazawagi-mura, Hiraga-gun, Akita Prefecture. Coarse grained sandstone of the Sugota formation (Miocene). Collected by Dr. K. ASANO and now preserved in the Department of Geology, College of Education, Tohoku University.

Chlamys nisataiensis OTUKA, 1934

Pl. 12, Figs. 1a–c, 2, 3a–b, 4, 5, 6, 7

1934 *Chlamys islandicus nisataiensis* OTUKA, *Bull. Earthq. Res. Inst., Imp. Univ., Tokyo, vol. 12, pt. 3,* pp. 612–613, pl. 47, fig. 26.

1940 *Pecten* (*Chlamys*) *nisataiensis* (OTUKA), NOMURA, *Sci. Rep., Tohoku Imp. Univ., Ser. 2, vol. 21, no. 1,* p. 18, pl. 2, figs. 5, 6.

The original description of this species is as follows:

"Shell moderate in size, the height almost equal to the length, subequivalve and subequilateral except for the ears, rather thin, compressed, radially costate. Beaks small, sharply pointed, approximate. Ears unequal, the anterior large, triangular, that of the right valve with a deep byssal notch; the posterior triangular, truncated behind at right angles or obtuse. Discs right angled above with the dorsal margin descending slightly concave meeting with the regularly rounded ventral margin at broad angles. Left valve more or less inflated than the right which margin is crenate. Sculpture: anterior of left valve with about 6-12 unequal scaly radial riblets (12 in the paratype of the left valve), that of the right valve divided into the upper area with flexuose, lamellated, horizontal, incremental lines; posterior ears with 6 to 12 low scarbrous riblets,

which interspaces with a feeble riblets; the riblet obsolete near the upper margin; discs with 30 to 33 subequal, equidistant, flat-topped, roundly edged ribs which are dichotomous at its ventral part (they show the dichotomous character after reaching a height of about 30 mm.); interspaces as wide as or a little narrower than the ribs, usually with an intercalating riblet; except for the posterior and anterior part. The posterior and anterior part densely ribbed, and the intercalating riblets obsolete. Incremental lines very fine, not much imbricated. Interior side obscurely radially grooved. Ventral margin strongly crenated".

The specimens collected from the Moniwa formation at Goishi in Oide-mura, Natori-gun, Miyagi Prefecture take the following description.

Shell small, rather thin, compressed, suborbicular, subequilateral, subequivalve, though the left is a little more convex than the right; radiately ribbed. Right valve with 25–32 flat-topped, somewhat square, radial ribs and intercalarly threads; radial ribs usually bifurcate at the lower half of disc length and usually as wide as or a little narrower than the interspaces at the upper half of disc, but tend to become broader than the interspaces with growth; intercalary threads appear at about same time as or a little earlier than rib-bifurcation, and subequal to bifurcated radials in strength at margin in adult specimens. Left valve with sculpture similar to that of right. Anterior auricle of right valve larger than the posterior, and with conspicuous byssal notch, narrow byssal area, and distinct ctenolium; the auricles sculptured with rather distinct radials and concentric lines, by which they appear somewhat imbricated. Anterior of left valve larger than the posterior which is provided with a shallow byssal notch, and of sculpture similar to that of right valve. Cardinal crura of right very distinct; lateral ridges of resilial pit distinct and with wide opening towards lower part. Internal surface of valves rather smooth except for marginal serration.

Dimensions (in mm).—

Valve	Right	Right	Right	Left	Left	Left
Height	30	22	19	24	23.5	21
Length	29	21	17	23	22	20
Hinge-length	14	10	—	11	10	11
Depth	4	3	3	4	4	3.5
Apical angle	90°	90°	90°	95°	—	90°

Remarks.—This species is characterized by the rather thin, small, rather compressed shell which is provided with 25–32 flat-topped, dichotomizing radial ribs, by the intercalary threads and by the right valve being less convex than the left one. The ribs are usually narrower than the interspaces on the upper half of the disc, but rarely the interspaces are narrower than the radial ribs. The relationship between radial ribs and their interspaces is not constant.

Chlamys akitana (YOKOYAMA) described in the earlier pages is very close to the present one, but can be distinguished from *nisataiensis* by the rather thick shell, subequal convexity of the valves, fewer number of radial ribs, by the radials being broader than their interspaces, and by the rare intercalary threads of the right valve as well as by the rare bifurcation of the left valve. The cardinal crura of this species is more distinct than in *akitana*.

Pecten (*Chlamys*) *jordani* ARNOLD, mentioned in earlier pages, is also

related to *nisataiensis*, but is distinguishable by the larger shell, much larger anterior auricle, and by the deeply channeled and narrower interspaces.

Geological significance. — The rocks from where *Chlamys akitana* (YOKOYAMA) has been collected or reported by authors comprises sandy siltstone as at Kurosawa, Taihei-mura, Minami-Akita-gun, Akita Prefecture, which is said to be the type locality of the species; this is the Wakimoto formation, granule conglomerate as at Kinonezaka, Yazawagi-mura, Hiraga-gun in the same Prefecture; this is the Sugota formation, coarse-grained sandstone as at Kitano, Yazawagi-mura in the same district and Prefecture; this is the Sugota formation, coarse-grained, tuffaceous sandstone as at Kumanodô, Takadate-mura, Natori-gun, Miyagi Prefecture; this is the Moniwa formation, and of green tuff as in the Kunnui formation in southwestern Hokkaiko as reported by T. NAGAO and Y. SASSA.

Chlamys nisataiensis OTUKA occurs in formations consisting of coarse-grained sandstone as at Nisatai, Nisatai-mura, Ninohe-gun, Iwate Prefecture; this is the Shiratori formation, and of granule conglomerate or of impure limestone as at Goishi and Kita-Akaishi, Oide-mura, Natori-gun, Miyagi Prefecture.

The conditions of the sea bottom on which the above mentioned two scallops once lived can be understood from the nature of the rocks which now preserve them. The thermal conditions of the sea at the time of the building of the Moniwa, Sugota, Shiratori and Kunnui formations is judged by the associated fauna of the two scallops, which comprise bivalves, univalves, echinoids and foraminifers of tropical to subtropical aspect. From the available data it is evident that the two scallops lived in the neritic zone upon a bottom free from mud derived from the land and under the influence of very mild thermal conditions.

Although the type locality of *Chlamys akitana* (YOKOYAMA) has been ascribed to the Wakimoto formation at Kurosawa, Taihei-mura, Minami-Akita-gun in Akita Prefecture, it is also evident that there are no subsequent records nor collections of the species from that locality, and that it is common in the Sugota formation and its correlatives. Accordingly, the writer feels that the locality of Kinonezaka, Yazawagi-mura, Hiraga-gun, Akita Prefecture (Sugota formation) is the true type locality and that the possibility of some mistake cannot be overlooked.

If the afore-mentioned statement concerning the type locality of *Chlamys akitana* (YOKOYAMA) proves to be as the writer now feels, it follows that both *Chlamys akitana* (YOKOYAMA) and *Chlamys nisataiensis* OTUKA are restricted in their geological range to early Miocene, or more precisely to Lower and Middle Miocene.

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Explanation of Plate 12

Figs. 1a-c. *Chlamys nisataiensis* OTUKA, a, Right valve, ×1, b, Inner surface, ×1, c, A part of outer surface of 1a, ×3, Loc. River floor of Natori River 200 m. downstream from Goishi Electric Power Plant, Oide-mura, Natori-gun, Miyagi Prefecture.

Fig. 2. *Chlamys nisataiensis* OTUKA, Right valve, ×1, Loc. Same as above.

Figs. 3a-b. *Chlamys nisataiensis* OTUKA, a, Right valve, ×1, b, Hinge area of 3a, ×3, Same Loc.

Fig. 4. *Chlamys nisataiensis* OTUKA, Left valve, ×1, Loc. Same as above.

Fig. 5. *Chlamys nisataiensis* OTUKA, Left valve, ×1, Loc. Same as above.

Fig. 6. *Chlamys nisataiensis* OTUKA, Left valve, ×1, Loc. Same as above.

Fig. 7. Hinge area of *Chlamys nisataiensis* OTUKA, Left valve, ×3, Loc. Same as above.

Figs. 8a-b. *Chlamys akitana* (YOKOYAMA), a, Right valve, ×2, b, Inner surface of 8a, ×2, Loc. Kitano, Yazawagi-mura, Hiraga-gun, Akita Prefecture.

Figs. 9a-b. *Chlamys akitana* (YOKOYAMA), a, Right valve, ×2, b, Inner surface of 9a, ×3, Loc. Same as above.

Fig. 10. *Chlamys akitana* (YOKOYAMA), Right valve, ×2, Loc. Same as abave.

Fig. 11. *Chlamys akitana* (YOKOYAMA), Right valve, ×2, Loc. Same as above.

Fig. 12a-b. *Chlamys akitana* (YOKOYAMA), a, Right valve. ×3, b, Hinge area of 12a, ×3, ditto.

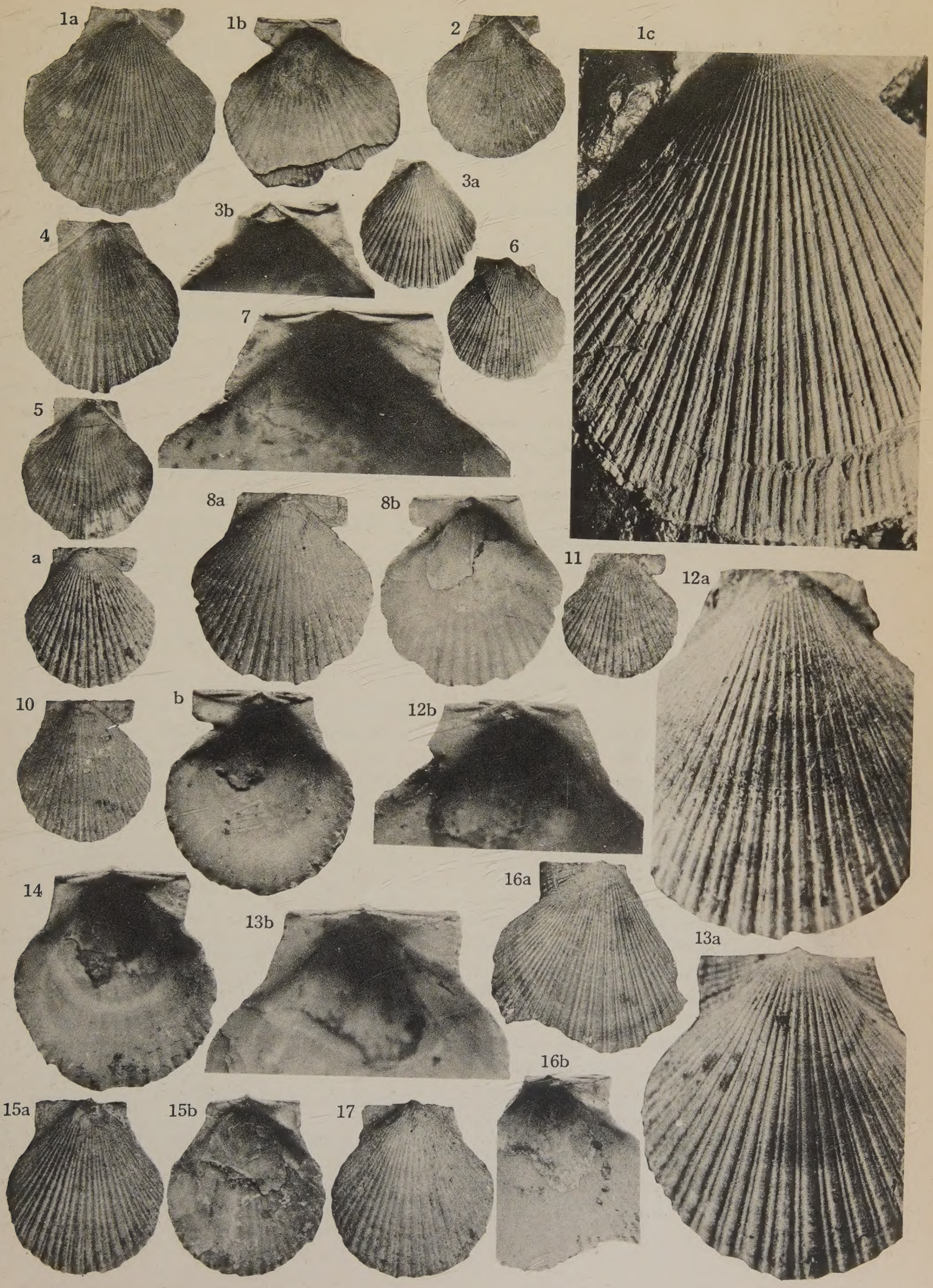
Figs. 13a-b. *Chlamys akitana* (YOKOYAMA), a. Left valve, ×3, b, Hinge area of 13a, ×3, ditto.

Fig 14. Inner surface of *Chlamys akitana* (YOKOYAMA), Left valve, ×3, Loc. Same as above.

Figs. 15a-b. *Chlamys akitana* (YOKOYAMA), a, Left valve, ×2, b, Inner surface of 15a, ×2, ditto.

Figs. 16a-b. *Chlamys akitana* (YOKOYAMA), a, Left valve, ×1, b, Inner surface of 16a. ×1, ditto.

Fig. 17. *Chlamys akitana* (YOKOYAMA), Left valve, ×2, Loc. Same as above.



K. KUMAGAI, Photo.

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243. NOTES ON SOME TERTIARY PLANTS FROM KOREA (TYÔSEN). III

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朝鮮産第三紀植物化石 III: 本篇では朝鮮半島中新世 Betulaceae のうち *Betula* 2 種, *Carpinus* 5 種, *Ostrya* 1 種を記載した。*Alnus* が認められなかつたのはむしろ奇異である。

藤岡一男

Contents

Fossil species of Betulaceae hitherto reported from Korea are as follows:

Betula cfr. *Ermanni* CHAM.
Kantindo formation of N. Kankyo Do (TATEIWA, 1925, name only).

B. spp.
Kantindo formation of N. Kankyo Do (TATEIWA, 1925, name only); *Engelhardtia* Bed of N. Kankyo Do (ENDO, 1938a, name only).

Carpinus carpinoides MAKINO (= *C. Japonica* BLUME) Kantindo formation of N. Kankyo Do (ENDO, 1939, p. 340, Pl. 23, Figs. 3, 4); Enniti series of N. Keisyo Do (KANEHARA, 1939, name only).

C. cuspidata SAPORTA
Enniti series of N. Keisyo Do (KANEHARA, 1936, name only).

C. erosa BLUME (= *C. cordata* BLUME)
Miocene beds of Keirin coal-mine, N. Kankyo Do (ENDO, 1950, p. 51, Pl. 6, Fig. 1).

C. erosa BLUME *ellipticibracteata* HUZIOKA
Kantindo formation of N. Kankyo Do (HUZIOKA, 1943b, p. 290).

C. hokoensis ENDO
Enniti series of Hoko, N. Keisyo Do (ENDO, 1950, p. 55, Pl. 6, Fig. 10).

C. Kodairae-bracteata HUZIOKA
Engelhardtia bed of N. Kankyo Do (HUZIOKA, 1943b, p. 290, Pl. 14, Figs. 14, 15, 15a).

C. kyushinensis ENDO
Miocene beds of Kyushin coal-mine, N. Kankyo Do (ENDO, 1950, p. 53, Pl. 6, Fig. 7).

C. protoerosa TANAI
Enniti series of N. Keisyo Do (TANAI, 1952, p. 232, Pl. 22, Fig. 2).

C. protojaponica ENDO
Miocene beds of Kyushin coal-mine, N. Kankyo Do (ENDO, 1950, p. 52, Pl. 6, Figs. 3, 5); Enniti series of N. Keisyo Do (TANAI, 1952, p. 231, Pl. 22, Fig. 1).

C. rancanensis HAYATA
Miocene beds of Kyushin coal-mine, N. Kankyo Do (ENDO, 1950, p. 52, Pl. 6, Fig. 4).

C. simplicibracteata HUZIOKA
Enniti series of N. Keisyo Do (HUZIOKA, 1943b, p. 290, Pl. 14, Figs. 13, 13a).

C. spp.
Kantindo formation (ENDO, 1938a, name

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only) and *Engelhardtia* bed (ENDO, 1938a, name only) of N. Kankyo Do.

In the present paper, the writer described the following species of Betulaceae from the Miocene floras of Korea: *Betula myongchonensis*, sp. nov., *B. shiragica*, sp. nov., *Carpinus carpinoides* MAKINO, *C. erosa* BLUME *ellipticibracteata* HUZIOKA, *C. miocordata* HU et CHANEY, *C. Kodairae-bracteata* HUZIOKA, *C. simplicibracteata* HUZIOKA, and *Ostrya shiragiana*, sp. nov.

Betulaceae are one of the most dominant families in the modern forests of the Korean peninsula, containing five genera of *Alnus*, *Betula*, *Carpinus*, *Corylus* and *Ostrya*. *Betula* and *Carpinus*, each of them bears many species and varieties respectively, are living almost in the whole peninsula. *Ostrya japonica* SARGENT, single species of the genus in Korea, grows merely in the most southern part of it.

Description of Species

Betula myongchonensis, sp. nov.

Pl. 13, Figures 1-2

Description:—Leaf ovato-elliptic to ovato-oblong, 6–10cm long and 2.5–4.0cm broad, acuminate at the apex, rounded at the base. Margin compoundly serrate. Midvein thick and straight to the apex; lateral veins 11–13 pairs in number, straight to the marginal teeth, leaving the midrib at angles of about 40°; some weak tertiary veins branched from the laterals at the marginal border to the smaller marginal teeth. Petiole thick, 1.0–1.5 cm long. Texture thin.

Comparison and remarks:—The present species shows an apparent resemblance to Asiatic living species such as *B. costata* TROUT., *B. sollennis* KOIDZ., *B. alnoides* HAMILTON, *B. insignis* FRANCH., and *B. Schmidti* REGEL. Above all, it seems to be most related to *B. alnoides* of Szechwan and Yunnan in China.

B. myongchonensis, sp. nov., is distinguished by its more elongated leaf from the allied European species such as *B. attenuata* GÖPPERT (1855, p. 11, Pl. 3, Fig. 6), *B. elliptica* SAPORTA (1867, p. 59, Pl. 5, Figs. 3, 4), and *B. Brongniarti* ETTINGSHAUSEN (1851, p. 12, Pl. 1, Figs. 16, 18). *B. vera* BROWN (1937, p. 171, Pl. 48, Figs. 7-11) of the Spokane flora of Washington is similar to our specimens in the elongate shape of leaf, excepting its slightly cordate base.

Occurrence:—Yutendo, Meisen-gun, N. Kankyo Do; Ryudo formation (Miocene); Coll. S. OISHI.

Betula shiragica, sp. nov.

Pl. 13, Figures 3-4

Description:—Leaf rhombic ovate or ovate, generally large, 7.0–11.5 cm long and 4.0–6.5 cm broad, acuminate at the apex, broadly cuneate at the base, irregularly duplicato-serrate at the margin. Midvein thick and straight to the apex; lateral veins equidistantly arranged, almost constantly 11 pairs in number, diverged from the midvein at angles of about 45°, straight or slightly up-curved to the marginal teeth, more or less decurrent at their bases; tertiary veins weak, leaved from the laterals at the marginal border to the smaller teeth; finer veins percurrent, forming minute reticular and polygonal meshes. Petiole rigid, about 1.5cm long. Texture seems to be somewhat thick.

Comparison and remarks:—In general appearances, the present fossil resembles *Betula globispica* SHIRAI in Central Japan, but differs from it in the more elongated shape of leaf and the incon-

spicuous teeth at the leaf margin. This Korean species may be essentially similar to *B. macrophylla* (GÖPPERT) HEER (GÖPPERT, 1855, p. 12, Pl. 4, Fig. 6; Pl. 5, Fig. 1, as *Alnus macrophylla*) and *B. grandifolia* ETTINGSHAUSEN (1866, p. 47, Pl. 14, Figs. 23, 24), but is distinguishable from them in having smaller marginal teeth, many lateral veins, and remarkable cuneate base. *B. mioluminifera* HU et CHANEY (1940, p. 30, Pl. 5, Figs. 5, 6; Pl. 7, Figs. 1, 2, 3; Pl. 9, Fig. 1) of the Shanwang flora in China and *B. sachalinensis* HEER (1878, p. 33, Pl. 6, Figs. 1-3) from the Dui coal-bearing formation of Sachalien also resemble our species, but the former has a rounded base and the latter has the lateral veins more densely arranged. *B. lucustris* MACGINITIE (1933, p. 50, Pl. 4, Figs. 2, 3, 4) of the Trout Creek flora in the Western United States shows a slight similarity to our leaves.

Occurrence:—Kinkodo, Usen-men, Geizitu-gun, N. Keisyo Do, Enniti series (Miocene); Colls. KODAIRA and UOTANI.

Carpinus carpinoides MAKINO

(syn. *C. japonica* BLUME)

1936. *Carpinus carpinoides*, KANEHARA: p. 82
1938. *Carpinus japonica*, ENDO: p. 340, Pl. 23, Figs. 3, 4

Some of the *Carpinus*-leaves which are almost unseperable from the existing *C. carpinoides* MAKINO occurred at the Enniti Miocene rocks. This species now grows widely in Japan and its fossils have been recorded from the Pliocene (MIKI, 1941) and Pleistocene (ENDO, 1940) floras of Japan.

Very recently, involucres of *C. protojaponica* ENDO which are very similar to those of the living *C. carpinoides* were reported by ENDO (1950, p. 52, Pl. 6, Fig. 2) from the Miocene beds of the Kyushin coal-mine of N. Kankyo Do and by TANAI (1952, p. 231, Pl. 22, Fig. 1) from the Enniti series of N. Keisyo Do.

Occurrence:—Kinkodo, Usen-men, Geizitu-gun, N. Keisyo Do; Enniti series (Miocene), Colls. KODAIRA and UOTANI; Kantindo, Meisen-gun, N. Kankyo Do, Kantindo formation (Miocene), Coll. OISHI.

Carpinus erosa BLUME *ellipticibracteata* HUZIOKA

1943b. *Carpinus erosa* BLUME *ellipticibracteata* HUZIOKA: p. 290, Pl. 14, Figs. 6, 7, 7a, 8, 8a, 9, 9a.

The fossil bracteole found by ENDO (1939, p. 339, Pl. 23, Fig, 5) from the Kantindo formation is doubtlessly similar to *Carpinus erosa* BLUME (syn. *C. cordata* BLUME). In 1943 HUZIOKA described *C. erosa ellipticibracteata* from the Miocene Abura flora of Hokkaido and included the Kantindo involucre in his new subspecies. *C. erosa ellipticibracteata* is very close to the modern involucres of *C. erosa* in Asia but generally oblong and elliptical in outline.

Occurrence:—Kantindo, Meisen-gun, N. Kankyo Do, Kantindo formation (Miocene).

Carpinus Kodairae-bracteata HUZIOKA

1943b. *Carpinus Kodairae-bracteata* HUZIOKA: p. 290, Pl. 14, Figs. 14, 15, 15a.

Description:—Involucre palmately trilobed. The median lobe is the largest, lanceolate, acuminate at the apex, coarsely serrate at the margin; lateral lobes small, trigonal, acuminate at the apices, slightly serrate at the

upper margins. The base of the involucre rounded. About 10 nerves radiate from the base, slender in habit; the median vein straight to the apex of the bracteole, branching some lateral veins at the way to the margin. Dimention of the type specimen: 2.3cm high, 1.2cm broad; stalk 4 mm long.

Comparison and remarks:—Of the living *Carpinus*, *C. laxiflora* BLUME which exists commonly in Northeastern Asia is most related to this fossil, but the living is much smaller, more roughly serrate at the margin, and less crowded in nervation. *C. shanwangensis* HU et CHANEY (1940, p. 34, Pl. 12, Fig. 6) has the trilobed bracteole which is morphologically similar to the present form.

Occurrence:—Ryuhokudo, Kokangen coal-mine, N. Kankyo Do, *Engelhardtia* bed (Miocene), Colls. KODAIRA and UOTANI.

Carpinus miocordata HU et CHANEY

Pl. 13, Figures 5-6

1936. *Carpinus subcordata*, KANEHARA: p. 82.
1940. *Carpinus miocordata* HU and CHANEY: p. 31, Pl. 12, Figs. 1, 2, 11.

Description:—Leaf large, generally 7–9 cm long and 4.0–4.5 cm broad, the largest one with 8 cm width and longer than 12 cm, oval, ovato-elliptic or obovato-elliptic in outline, acuminate at the apex, distinctly cordate at the base. Margin densely and compoundly serrate, but some seeming simply serrate; marginal teeth sharply pointed. Midvein rigid, straight to the apex; lateral veins parallel, eqidistantly arranged, straight or slightly up-curved to the marginal teeth, 13–18 pairs in number, diverging at angles of approximately 45° from the midvein; tertiary veins branched from the laterals near the margin to reach the smaller teeth; finer veins weak, percurrent. Petiole unknown. Texture seems to be thin.

Comparison and remarks:—The present specimens are quite identical with *Carpinus miocordata* HU et CHANEY of the Miocene Shanwang flora, China. *C. miocordata* is most closely comparable with *C. erosa* BLUME (syn. *C. cordata* BLUME) of the temperate forests of Northeastern Asia. HU et CHANEY (1940) distinguished this species from *C. subcordata* NATHORST (1883, p. 39, Pl. 2, Figs. 13, 18, 20) of the Mogi flora, but the morphological resemblance between these two species is quite obvious, both being closely similar to the living *C. erosa*.

Occurrence:—Kinkodo, Usen-men, Geizitu-gun, N. Keisyo Do, Enniti series (Miocene), Colls. KODAIRA and UOTANI.

Carpinus simplicibracteata HUZIOKA

1943b. *Carpinus simplicibracteata* HUZIOKA: p. 290, Pl. 14, Figs. 13, 13a.

Description:—Involucre small, long elliptic in outline, acuminate at the apex, bearing a pair of teeth at the apical margin, obtuse at the base. Primary nerves three in number, radiate from the base of involucre; the median vein strongest and straight to the apex, the lateral two end in the apical marginal teeth. Dimension of the type specimen: 1.7 cm high and 0.65 cm broad.

Comparison and remarks:—Apparently the present bracteole seems to belong to the genus *Ostrya*, but the writer referred it to the genus *Carpinus* by the presence of marginal teeth and the characters of nervation. This type of bracteole may belong essentially to *C. erosa* group, though this is quite curious in having the simple characters by which this species is easily distin-

guishable from *C. erosa* and *C. erosa ellipticibracteata*.

Occurrence:—Kinkodo, Usen-men, Geizitu-gun, N. Keisyo Do, Enniti series (Miocene), Colls. KODAIRA and UOTANI.

Ostrya shiragiana, sp. nov.

Pl. 13, Figures 7–8.

Description:—Leaf elliptic ovate, 7.0–7.5 cm long and 3.5–4.0 cm broad. Apex acute, base broadly cuneate or cuneato-obtuse, slightly inequilateral. Margin irregularly duplicato-serrate. Midvein rather thick, straight to the apex; lateral veins alternate or subopposite, parallel, straight to the marginal teeth, 11–13 pairs in number, diverging from the midvein at angles of 45°; some distinct tertiary veins leaved from the laterals near the margin to the marginal teeth; finer veins obscure. Petiole thick, about 1.0 cm long. Texture seems to be rather thin.

Comparison and remarks:—Three species of *Ostrya*, *O. japonica* SARGENT, *O. Rehderiana* CHUN and *O. Liana* HU, are now living in Eastern Asia. Among them *O. japonica* is most widely distributed in Japanese Islands, southern Korea and Middle China. In both of *O. japonica* and *O. Rehderiana*, the leaf is caudato-acuminate at the apex and its petiole is shorter than 1.0 cm, and in *O. Liana* the leaf is generally cordate at the base.

Four fossil forms of *Ostrya* have been reported from the Japanese Neogene Tertiary; they are *O. japonica* of the Nenoshiroishi flora near Sendai (ENDO, 1938b, p. 619) and the Heigun flora of Yamaguti Pref. (HUZIOKA, 1938, p. 148), *O. virginica* WILD. *fossilis* NATHORST of the Mogi flora (NATHORST, 1883, p. 42, Pl. 3, Fig. 2) and the Omi flora in Nagano Pref. (KON'NO, 1931, Pl. 9, Fig. 2), *O. Knowltonii* CONVILLE (?) of the Uchiyama flora in Nagano Pref. (ENDO, 1933, p. 49, Fig. 10) and *O. japonica oblongibracteata* HUZIOKA (1943b, p. 289, Pl. 14, Figs. 1, 1a, 2) of the Abura flora in Hokkaido. The former two of them are represented by leaves and the latter two by involucres. *O. virginica fossilis* of Mogi may belong to the genus *Ulmus* as already pointed out by ETTINGSHAUSEN (1883, p. 858).

In the general characters, leaves of *O. oregoniana* CHANEY (1927, p. 106, Pl. 9, Fig. 12) from the Bridge Creek flora of Oregon are closely related to this Korean species. Another foreign similar species is *O. oeningensis* HEER (1856, p. 42, Pl. 73, Figs. 5–10) of the Swiss Miocene flora though it is cordate at the base.

Occurrence:—Kinkodo, Usen-men, Geizitu-gun, N. Keisyo Do, Enniti series (Miocene), Colls. KODAIRA and UOTANI; Yutendo, Meisen-gun, N. Kankyo Do, Ryudo formation (Miocene), Coll. OISHI.

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Localities of the described species

Ryuhokudo, Kokangen coal-mine, N. Kankyo Do; *Engelhardtia* bed (咸鏡北道，古乾原炭礦，竜北洞；*Engelhardtia* 層).

Salvinia pseudoformosa OISHI et HUZIOKA, Cfr. *Platanus Guillelmae* GÖPPERT, *Fagus koraica* HUZIOKA. *F. protolongipetiolata* HUZIOKA, *F. Uotanii* HUZIOKA, *Zelkowa Tibae* OISHI et HUZIOKA, and *Carpinus Kodairae-bracteata* HUZIOKA.

Kantindo, Meisen-gun, N. Kankyo Do; Kantindo formation (咸鏡北道，明川郡咸鎮洞；咸鎮洞層)

Acer subpictum SAPORTA, *A. ezoanum* OISHI et HUZIOKA, *A. trilobatum* (STERNBERG) var. *productum* AL. BRAUN, *A. japonicum* THUNBERG, *A.* (samarae) spp., *Fagus protolongipetiolata* HUZIOKA, *Ulmus carpinoides* GÖPPERT, *Zelkowa Ungeri* (ETT.) KOVATS, *Carpinus carpinoides* MAKINO, and *C. erosa* BLUME *elliptici-bracteata* HUZIOKA.

Yutendo, Meisen-gun, N. Kankyo Do; Ryudo formation (咸鏡北道，明川郡，熊店洞；竜洞層).

Tilia distans NATHORST, *T. japonica* SIMONKAI, *T. meisenensis* HUZIOKA, *T. subnobilis* HUZIOKA, *Acer rotundatum* HUZIOKA, *A. subpictum* SAPORTA, *A.* sp., *A.* (samarae) spp., *Zelkowa Ungeri* (ETT.) KOVATS, *Betula myongchonensis*, sp. nov., and *Ostrya shiragiana*, sp. nov.

Kissyu-town, Kissyu-gun, N. Kankyo Do; White Shale of Kissyu formation (咸鏡北道，吉州郡，吉州邑；吉州層白色頁岩).


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Tilia distans NATHORST, *Acer subpictum* SAPORTA, *Ulmus shiragica* HUZIOKA, and *Zelkowa Ungeri* (ETT.) KOVATS.

Kinkodo, Usen-men, Geizitu-gun, N. Keisyo Do; Enniti series (慶尙北道, 迎日郡, 烏川面, 金光洞; 延日統).

Tilia remotiserrata OISHI et HUZIOKA, *Acer rotundatum* HUZIOKA, *A. subpictum* SAPORTA, *A. fatsiaefolia* HUZIOKA, *A. ornatum* CARR., *Ulmus shiragica* HUZIOKA, *Zelkowa Ungeri* (ETT.) KOVATS, *Betula shiragica*, sp. nov., *Carpinus carpinoides* MAKINO, *C. miocordata* HU et CHANEY, *C. simplicibracteata* HUZIOKA, and *Ostrya shiragiana*, sp. nov.

Explanation of the Plate 13

(The figures are of natural size)

The specimens are stored in the Institute of Geology and Mineralogy, Faculty of Science, Hokkaido University, Sapporo

Figs. 1–2. *Betula myongchonensis*, sp. nov. Loc. Yutendo, Meisen-gun, N. Kankyo Do, Ryudo formation.

Figs. 3–4. *Betula shiragica*, sp. nov. Loc. Kinkodo, Usen-men, Geizitu-gun, N. Keisyo Do, Enniti series.

Figs. 5–6. *Carpinus miocordata* HU et CHANEY Loc. Ditto.

Figs. 7–8. *Ostrya shiragiana*, sp. nov. Loc. Ditto.

PROCEEDINGS OF THE PALAEONTOLOGICAL SOCIETY OF JAPAN

「日本古生物学会第56回例会」 昭和28年12月19日大阪市立大学理工学部地学教室に於て開催す（参会者16名）。講演者並に講演題目次の如し。

勝浦産白堊紀石炭中の花粉胞子化石 ……………………………………………………島倉巳三郎

Trapa の花粉化石に就いて ………島倉巳三郎

南部九州の植物化石 ………………春 成 兼 俊

Some Views on the Mesozoic Verticillate Leaves from Japan and Korea… …………………………… KOBATAKE, Nobuo

Fossil Plants of the Kyöngsang Formation…………………… KOBATAKE, Nobuo

On the New Genus *Taiwanasagaoites* from the Neogene Formation of Fukui Prefecture, the Inner side of Central Japan（代読）………………… ………………………… MATSUO, Hidekuni

Occurrence of Miocene Foraminifera from Sasebo Group（代読）…………… …………………………… MURATA, Shigeo

愛媛県東宇和郡土居村の下部ペルム系（男地層）の紡錘虫について（代読） ……………………………………石 井 健 一

瀬戸川統産の Bryozoa について（予報）（代読） ……………………………今 泉 力 蔵

A New Species of *Edentula* from the Upper Triassic Mine Group of Yamaguchi Prefecture, Japan ……… ……………………………NAKAZAWA, Keiji

Discovery of *Actinodontophora* and other Pelecypods from the Permian of the Kitakami Mountainland（代読） …………………………ICHIKAWA, Koichiro

Turcicula の新化石種について（代読）… …………………………………… 大 山 桂

古琵琶湖層群の化石 ………………池 辺 展 生

On the Occurrence of *Glyptophiceras* from the Province of Yamasaki, Hyogo Prefecture, Japan …………… NAKAZAWA, Keiji & SHIMIZU, Daikichiro

「日本古生物学会第57回例会」昭和29年2月13日北海道大学 理学部地質 鉱物学教室に於て開催す（参会者11名）。講演者並に講演題目次の如し。

1. 新潟県鮮新世の新属新種 *Oinomikadoina ogiensis* MATSUNAGA について（代読） …………………松 永 孝
2. 北上山地長岩統床板珊瑚について … …………………………………… 武 田 祐 幸
3. 北上山地二畳紀腕足類概報 … 早 坂 一 郎・湊 正 雄
4. 北海道産 *Mericenaria* 属の化石について…………………………… 魚 住 悟
5. *Neptunea shitakaraensis* の変異 …… ………………………………… 松 井 愈
6. *Yoldia laudabilis* YOKOYAMA について（代読） …………………水 野 篤 行
7. 静岡市北方瀬戸川累層群 "上部" 産の化石（代読） ………………水 野 篤 行
8. 中新世初期の貝化石群集（代読）…… ………………………………… 水 野 篤 行
9. An Occurrence of *Koninckioceras* from the Japanese Permian……… ………………………HAYASAKA, Ichiro
10. Notes on the Motodo Volcanic Conglomerate, Hida Mountainland, with Special Reference to Some Microfossils of Its Limestone Pebbles（代読） ………KONISHI, Kenji

「日本古生物学会 1954 年度年会」昭和29年4月30日秋田大学鉱山学部に於て開催す。同会席上で審議の上，会則第13条を次の如く改正した。

（アンダーラインは変更個所）

第13条 ──会費は正会員年 600円（但し在外会員年 3$）

註 ① 1954年度（1月～12月）から本会則による ② 外国会員には Special papers 及びその郵送料を含む。

Trans. Proc. Palaeont. Soc. Japan, N.S., No. 13, pp. 125-130, Pl. 14, June 15, 1954

244. ELECTRON-MICROSCOPIC FINE STRUCTURE OF FOSSIL DIATOMS. I*

HARUO OKUNO

Kyoto University of Textile Fibers

化石珪藻の電子顕微鏡的微細構造. I: 化石珪藻の電子顕微鏡的微細構造を研究することが，植物化石，形態，分類学及び地質変動，層位学などに対してもつ意義を述べ，電子顕微鏡による化石珪藻の検鏡法についても記した。*Coscinodiscus elegans*（佐渡ヶ島沢根町及び隠岐ノ島西郷町産），*Cosc. lineatus*（佐渡ヶ島沢根町産），*Cosc. marginatus*（隠岐ノ島西郷町産），*Cosc. oculusiridis*（大阪府山田村及び石川県石崎村産）などにつき，それぞれの珪殻の微細構造を詳しく記した。

奥野春雄

Introduction

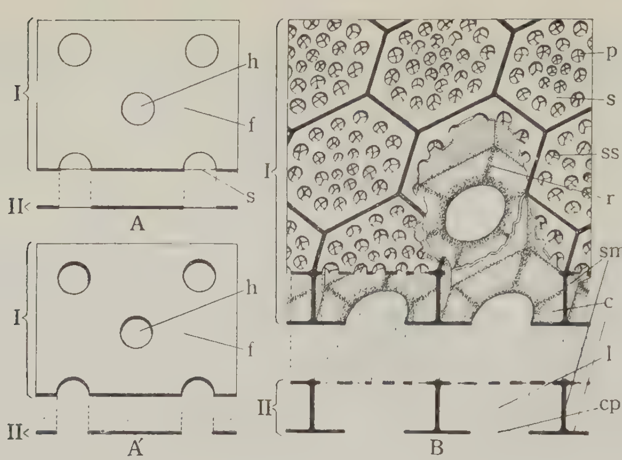
Some of the fine structure of the diatom frustules are far beyond the highest resolving power of the light microscope. Especially the fine structure of the frustule pores are so minute that they can be revealed in detail only by the electron microscope.

The frustule pores can be classified by their electron-microscopic fine structure into two types, one the 'hole**', and the other the 'loculus' (Text-fig. 1). The former is a pore, not locular and opened freely or closed with one sheet of sieve membrane, and the latter is a locular pore closed with two sheets of membranes, the outer sieve membrane and the inner cover membrane. The sieve membrane of the loculus is usually perforated by many sieve pores of various shapes and sizes, and the cover membrane is perforated by a cover pore. (Cf. OKUNO, 1949, *Bot. Mag. Tokyo, vol. 62*, p. 136, fig. 1; 1951, *Journ. Jap. Bot., vol. 26*, p. 308, fig. 1; 1952, l.c., *vol. 27*, p. 48, 350, fig. 1.) In the sieve membrane of the hole, I can not yet ascertain the existence of such distinct sieve pores as in the loculus. And in the fossil frustules, the sieve membranes of the hole and the loculus are often lost by weathering.

According to my researches, the electron-microscopic fine structure of the frustule pores are peculiar to the species. And, in general, in the cells of the same species, variety or form, the frustule pore of the same fine structure was found. Thus, I have probationally classified the diatom frustules by their electron-microscopic fine structure of the frustule pores into about 23 groups (OKUNO, 1953, *Bot. Mag. Tokyo, vol. 66*, pp. 121–124). Sometimes, as noteworthy facts, even in the frustule pores of the diatoms of different genera, families, or orders, I could find common electron-microscopic fine structure. For example, the frustule pores of *Arachnoidiscus ornatus* (*Centrales — Actinodiscaceae*; OKUNO, 1949, *Bot. Mag. Tokyo, vol. 62*,

* 1) Read Oct. 10, 1953; received Oct. 14, 1953.
2) This research was aided by a Grant in Aid for Scientific Research from the Ministry of Education.

** In my previous papers, written as 'simple pore'.



Text-fig. 1. Diagram of the frustule pores. A, A′, Hole. B, Loculus (*Coscinodiscus oculus-iridis*). I, View from obliquely above, with the idealistic longitudinal (pervalver) section. II, Idealistic longitudinal (pervalver) section. c, Cover membrane. cp, Cover pore. f, Frustule. h, Hole (in fig. A, with, and in fig. A′, without the sieve membrane). l, Loculus. p, Sieve pore. r, Ray. s, Sieve membrane. sm, Side membrane. ss, Secondary sieve membrane.

p. 97, pl. 3, fig. 3), *Cocconeis scutellum* (upper valve) (*Pennales—Achnanthaceae*; OKUNO, 1950, l.c., *vol. 63*, p. 101, pl. 3, figs. 6-6″), and *Didymosphenia geminata* var. *curvata* (*Pennales—Naviculaceae*; OKUNO, present study, II, pl. 2, figs. 5a–d), all these have the similar sieve membrane with the distinct, dendriform thickenings. The frustule pores of *Triceratium Shadboltianum* var. *elongata* (*Centrales—Biddulphiaceae*; OKUNO, 1950, *Bot. Mag. Tokyo, vol. 63*, p. 99, pl. 2, figs. 4, 4′) and *Biddulphia Titiana* (*Centrales — Biddulphiaceae*; OKUNO, Electron micrograph, no. S. 338-340—not yet published) are similar, both having 2–3 horse-shoe shaped sieve pores disposed oppositely or circularly. On the other hand, in some species of the same genus, I could find the frustule pores of distinctly different structure. For example, *Achnanthes longipes* has the netveined sieve membrane (OKUNO, 1953, l.c., *vol. 66*, p. 6, pl. 2, figs. 1–1b"), while *Ach. lanceolata* (KOLBE, 1943, *Ber. Dt. Bot. Ges., vol. 61*, p. 95, pl. 4, fig. 15; OKUNO, 1953, l.c., *vol. 66*, p. 7, pl. 2, figs. 2, 2′) and f. *ventricosa* (OKUNO, present study, II.—in print) have the sieve membrane with round sieve pores arranged in transverse rows. *Navicula cuspidata* var. *ambigua* (OKUNO, 1953, l.c., p. 5, pl. 1, figs. 2, 2′) and *Nav. lyra* var. *constricta* (OKUNO, 1950, 1. c., *vol. 63*, p. 103, pl. 4, figs. 2, 2′) have, like many other *Navicula* species, transverse rows of roundish-rectangular holes, while *Nav. yarrensis* (OKUNO, 1950, 1. c., figs. 1, 1′) and *Nav. elegans* (OKUNO, 1950, 1. c., figs. 4, 4′) have the transversely broad loculus with finely porous sieve membranes, which are rather peculiar to *Pinnularia!* Thus, the fine structure of the frustule pore is on the one hand peculiar to the species and on the other hand somewhat

relationless to the present light microscopic classification of diatoms. And, it may be possible to suggest a new classification of diatoms by their electron-microscopic structure, instead of the present light-microscopic classification.

It is conceivable that the frustules of the fossil diatoms, especially their delicate sieve membranes, are more or less damaged by long physical and chemical weathering. The degree of destruction of the frustules will be determined by the total of the physical and chemical weathering. And the longer and more powerful the geological weathering, the more complete the destruction of the fossil frustules will be. Thus, the degree ofdestruction of the frustules of the same species from different localities will indicate the different intensities of weathering. Further, it may even be possible to trace the development of the fine structure of the diatoms or the development of the diatoms themselves by comparing in detail the fine structure of the fossil frustules of different geological ages.

Diatomaceous earths, both of fresh water and marine origin, cover a wide range of applications in major industrial fields. After refined, they are used as the filter-aid in conjunction with filter presses or other equipment in the filtration of liquids of all kinds—acids, beer, casein, cider, enamels, fruit juices, gelatine, glucose, gums, milk, oils, penicillin and other pharmaceuticals, soap, sugars, water, wine, etc. As fillers, they are used in the following products—asphalt, carriers of catalysts, ceramics, concrete, polishes, rubber, textiles, etc. As thermal insulators, the pulverized diatomaceous earth and the calcined diatomaceous bricks are employed to reduce heat waste, to save fuel and increase efficiency in the following equipments—boilers, furnaces, kettles, kilns, ovens, tanks, tubes, etc. These vast uses of the diatomaceous earths almost entirely depend upon their specific physical and chemical properties—lightness, purity, inertness, heat resistance, uniformity and extraordinarily high porosity of the fossil frustules! As the excellent filtration and absorption power of the diatomaceous earth depends, to a certain extent, upon their minute frustule pores, the electron-microscopic studies of the fine structure of the frustule pores will foreshadow improvements of the industrial application of diatomaceous earth.

The electron micrographs presented here were photographed partly with the SHIMADZU magnetic 'SM-II' electron microscope at our laboratory, partly with the 'SM-CII' at SHIMADZU Works, Kyoto, and partly with the 'SM-I' at Osaka University, each operation at about 40–50kV.

I wish to express my hearty thanks to Dr. Shin-ichi SHIMADZU and his collaborators, Messrs. Yoshinori TONOMURA and Yûtarô WATANABE of Shimadzu Works, and Dr. Gompachirô YASUZUMI and his collaborator, Mr. Akira TANAKA of Osaka University, all of whom kindly gave me the opportunity of taking many electron micrographs at their laboratories. Further, I take this opportunity of thanking Mr. Kiichirô KUROSAWA of our laboratory for his aid in many ways.

Preparation of Fossil Diatoms for Electron Microscopy

The fossil diatoms being almost naturally removed of their cell contents by long weathering, they are luckily in many cases ready for the electron-microscopic preparation. In the present research, in order to obtain the electron

micrograph of the undamaged frustules, such treatments as boiling the fossils in acid or calcinating them at high temperature were avoided in the course of preparation. After being washed in distilled water, the fossil frustules were dropped on the slide glass and were prepared as the dry preparation. While examining the dry preparation under the low-power light microscope, a piece of the upper or the lower valve, or its fragment, was caught with the help of a sharp needle operated by the free hand, and was transfered and attached to the collodion membrane of the sample holder. The supporting collodion membrane with the fossil frustules on it, was exposed for two or three seconds to aqueous vapour to fix the fossil frustules. Sometimes the frustules were attached to the sample holder without the supporting membrane in such a manner that a portion of the fossil frustule was projected into the pore of the holder to be exposed directly to the electron beam. Such a preparation, without the supporting membrane, I called the 'direct preparation' (OKUNO, 1953, *Bot. Mag. Tokyo, vol. 66*, p. 159). The direct preparation, after being exposed to aqueous vapour as the collodion preparation, was put into the electron microscope for observation. From the direct preparation, without the hindrance of the supporting membrane, I could always obtain more exact and sharper images of the fine structure of the fossil frustules than from the collodion preparation.

Description of Species

Coscinodiscus elegans GREVILLE

Pl. 14, figs. 1a–c.

Coscinodiscus elegans GREVILLE, A. SCHMIDT, 1886, At. Diat., pl. 58, fig. 7—MILLS, 1933, Index, p. 470.—OKUNO, 1950, *Bot. Mag. Tokyo, vol. 63*, p. 98, pl. 1, figs. 4, 4'.

Valves about 38–70 μ in diameter. Central area hyaline. Frustule pores polygonal, locular, about 4 in 10 μ, arranged in radiating rows. In the submarginal zone, with 2–3 circles of smaller frustule pores. Marginal zone striated, striae about 13–14 in 10 μ. In many specimens from Hirosaki Basin and Oki Island, the sieve membranes of the frustule pores were almost completely lost as shown in fig. 1b. Only in few specimens from Oki Island, I could find more or less well preserved thin membranes, which I thought to be the sieve membranes (fig. 1c). These membranes in the loculi were very thin, and electron-microscopically seem not porous. According to my research, *Coscinodiscus* species both of living and fossil forms, were found with distinctly porous sieve membranes. And such a sieve membrane without sieve pores as in the present species, is not yet found by me in other *Coscinodiscus* species.

Habitat: Marine, planktonic.

Occurrence: Fig. 1a. In diatomite. (Specimen, no. 1346) Sawane-chô, Sado Island, Niigata Prefecture. Upper Miocene, Nakayamatôge Formation. Fig. 1b (Obtained from the specimen boiled in hydrochloric acid). In mudstone. (Specimen, no. m 744, collected by T. KANAYA.) Fig. 1c. In diatomite. (Specimen, no. 923) Mt. Iinoyama, Saigô-chô, Oki Island, Shimane Prefecture. Middle or Upper Miocene or Lower Pliocene, Dôgo Group.

Coscinodiscus lineatus EHRENBERG

Pl. 14, figs. 2a–c.

Coscinodiscus lineatus EHRENBERG, HUSTEDT,

1930, Kieselalg., Teil. 1, p. 392, fig. 204.—MILLS, 1933, Index, p. 483.—LONG, FUGE and SMITH, 1946, *Journ. Paleont. vol. 20*, p. 103, pl. 16, fig. 5.—OKUNO, 1949, *Bot. Mag. Tokyo, vol. 62*, p, 97, pl. 3, fig. 2; 1950, l.c., p. 98, pl. 1, figs. 5, 5′; 1952, At Foss. Diat., pl. 8, fig. 1, pl. 19, fig. 1.

Valves about 50–130 (30–150) μ in diameter. Frustule pores locular, usually hexagonal, about 4 (3–5) in 10 μ, arranged in three straight lines decussating at about 60 degrees. Marginal zone striated, striae about 8–9 (7–12) in 10 μ. Sieve membranes of the loculi with round sieve pores about 150–200m μ in diameter. Sieve pores about 3.5–5 in 1 μ, arranged in three straight or slightly curved lines decussating at about 60 degrees. Cover pores of the loculi, round, about 1.2–1.6 μ in diameter. In fossils, the sieve membranes are usually more or less lost.

Habitat: Marine, pelagic.

Occurrence: Figs. 2a, b. In diatomite. (Specimen, no. 1346) Sawane-chô, Sado Island, Niigata Prefecture. Upper Miocene, Nakayamatôge Formation. Fig. 2c. Living form; Antarctic plankton. (Specimen, no. m620; sent from the Taiyô Fishery Company, Tokyo.) 171°41′ W: 77°7′S. Jan. 1951.

Coscinodiscus marginatus EHRENBERG

Pl. 14, figs. 3a–c.

Coscinodiscus marginatus EHRENBERG, HUSTEDT, 1930, Kieselalg., Teil. 1, p. 416, fig. 223.—MILLS, 1933, Index, p. 484.—LONG, FUGE and SMITH, 1946, *Journ. Paleont. vol. 20*, p. 104, pl. 16, fig. 13.

Valves almost flat, sharply fall off at the margin. Diameter about 55–80 (37–200) μ. Frustule pores polygonal, locular, 1.5–2.5 (1.5–4) in 10 μ. Marginal zone broad, with coarse striae about 4–5 (1.5–6) in 10 μ. Sieve membranes of the loculi with round to roundish-polygonal sieve pores, about 3 in 1μ, about 500mμ in diameter. In many frustules, the sieve membranes are lost. In the frustules of the living forms, I have found the secondary sieve membrane which divide the sieve pore into several secondary sieve pores (fig. 3c). In the fossils, I could not yet find such secondary sieve membranes. They are probably lost.

Habitat: Marine, pelagic.

Occurrence: Fig. 3a, b. In diatomite. (Specimen, no. 923) Mt. Iinoyama, Saigô-chô, Oki Island, Shimane Prefecture. Middle or Upper Miocene or Lower Pliocene, Dôgo Group. Fig. 3c. Living form; North Pacific plankton. (Specimen, no. m698; collected by H. MAEDA.) 164°6′ E: 49°30′N. Jul. 1952.

Coscinodiscus oculus-iridis EHRENBERG

Text-fig. 1, B; Pl. 14, figs. 4a–c.

Coscinodiscus oculus-iridis EHRENBERG, MILLS, 1933, Index, p. 491.—OKUNO, 1950, *Bot. Mag. Tokyo, vol. 63*, p. 232; 1951, *Geol. Sci. Kyoto, no. 6*, p. 61, pl. 3, figs. 4, 4′.

Valves about 160 (100–300) μ in diameter. Central rosette distinct, sometimes with a small hyaline area in its centre. Frustule pores locular, 3–4 in 10 μ, largest at about the half of the radius of the valve, and increasing to 4.5 at the margin. In both specimens from Ishizaki-mura and Yamada-mura, the sieve membranes of the loculi are well preserved. Sieve pores round to roundish-polygonal, about 100–200mμ (Yamada specimen) to 150–300 mμ (Ishizaki specimen) in diameter, somewhat concentrically distributed over the sieve membrane (Text fig. 1, B–p). In

Pl. 14, fig. 4c, the sieve pores at the marginal part of the sieve membrane are seen faintly through the cover membrane. Secondary sieve membranes (cf. OKUNO, 1951, *Journ. Jap. Bot., vol. 26*, p. 308, Text fig. 1) are almost completely lost. Cover membranes distinct, somewhat thick at their inner margins. Cover pores round, about 1–1.5 μ in diameter. On the cover membrane, several rays radiating from the border of the cover pore to the corners of the loculus are seen with the light microscope (Text fig. 1, B–r).

Habitat: Marine, pelagic.

Occurrence: Figs. 4a, b. In clay. (Specimen, no. ICHIHARA, K 10) Yamada-mura, Mishima-gun, Osaka Prefecture. Pleistocene, Ibaragi Formation, Osaka Group. Fig. 4c. In diatomite. (Specimen, no. 1327, E153) Ishizaki-mura, Kashima-gun, Ishikawa Prefecture. Miocene, Wakura Formation, Fugeshi Group.

Explanation of Plate 14

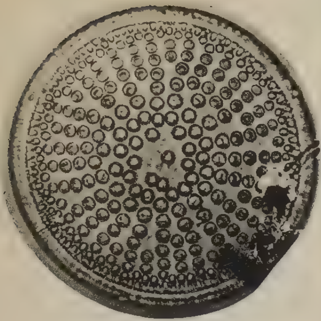
L. M.: Light Micrograph. E. M.: Electron Micrograph.
Electron micrographs without special remarks were all obtained from the direct preparations.

Figs. 1a–c. *Coscinodiscus elegans* GREVILLE. 1a, Sawane-chô, Sado Island, Niigata Pref. (L. M. ×300). 1b, Hirosaki Basin, Aomori Pref. (E. M. ×2200). 1c, Saigô-chô, Oki Island, Shimane Pref. (E.M. ×9600).

Figs. 2a–c. *Coscinodiscus lineatus* EHRENBERG. 2a, b, Sawane-chô, Sado Island, Niigata Pref. 2a (L.M. ×600). 2b (E.M. ×7500). 2c, Recent; Antarctic. (E.M. ×12500).

Figs. 3a–c. *Coscinodiscus marginatus* EHRENBERG. 3a, b, Saigô-chô, Oki Island, Shimane Pref. 3a (L.M. ×800). 3b (E.M. ×4500). 3c, Recent; North Pacific. (E.M. ×11000).

Figs. 4a–c. *Coscinodiscus oculus-iridis* EHRENBERG. 4a. b, Yamada-mura, Osaka Pref. 4a (L.M. ×500). 4b (E.M. ×13000). 4c, Ishizaki-mura, Ishikawa Pref. (E.M. ×7000).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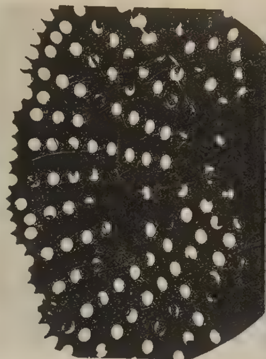
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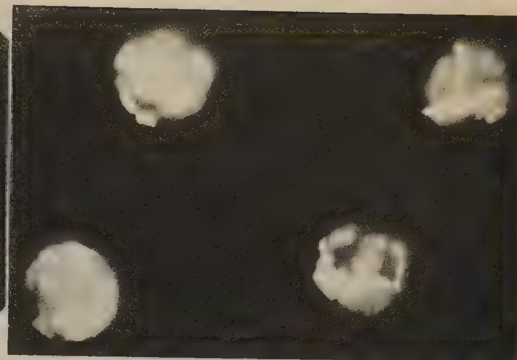
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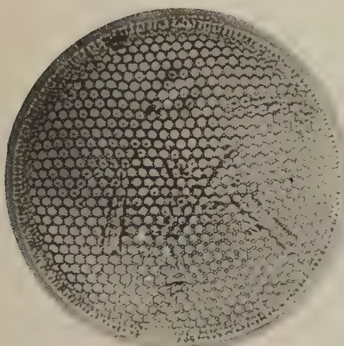
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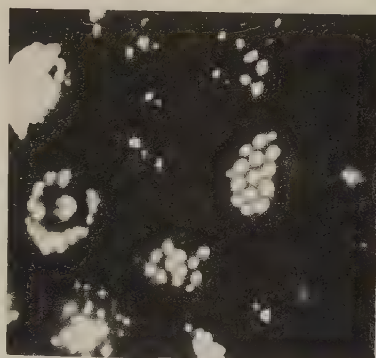
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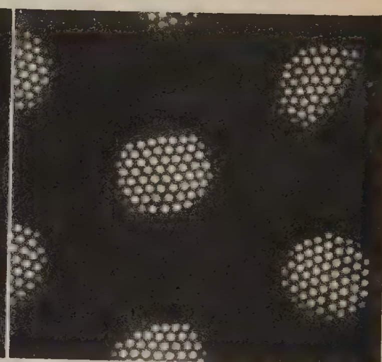
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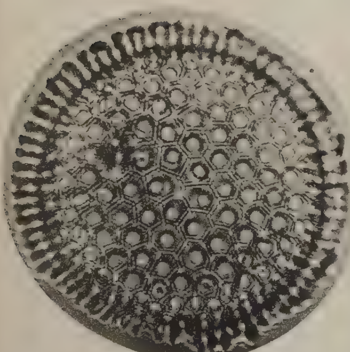
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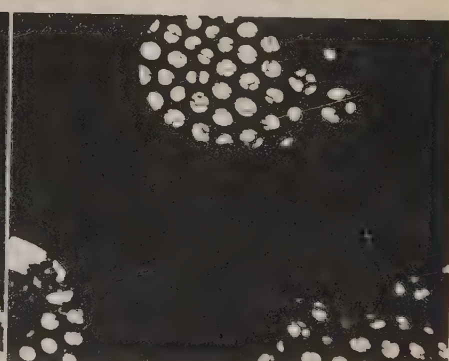
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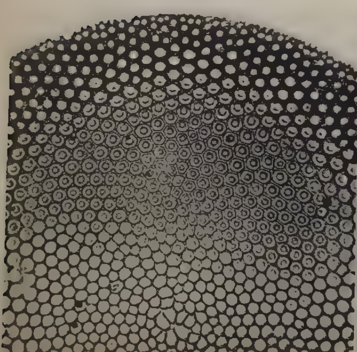
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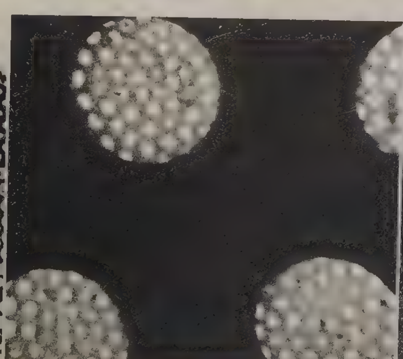
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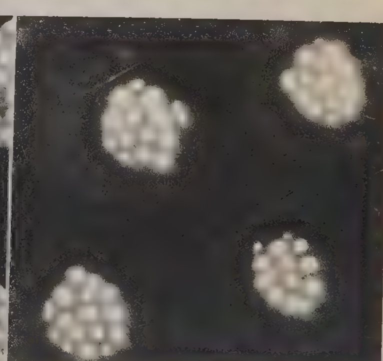
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Trans. Proc. Palaeont. Soc. Japan, N.S., No. 13, pp. 131—132, Pl. 15, June 15, 1954

245. RECENT AND FOSSIL SPECIES OF *BRISSUS* FROM RYUKYU*

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琉球産 *Brissus* の現生種および化石種：九大動物学教室所蔵の海膽標本中に石垣島産 *Brissus* の現生種および化石種を見出し，両者を比較記載し，化石種では周花帯線，肛下帯線の保存されにくいことを指摘した。　森下　晶

When I called on the Zoological Institute of Kyusyu University in April of the year 1952, I found the recent and fossil species of *Brissus* from Ishigaki-jima, Ryukyu Islands in the late Hayato IKEDA's collections of Echinoids. Professor Yoshikuni HIRAIWA kindly permitted me to examine both the specimens, consequently identified with *Brissus latecarinatus* LESKE. Fortunately as they were obtained at the same place, Ishigaki-jima, it seems interesting to compare them in detail, observing specially the preservation of the fossil specimen. The fossil one is found in the limestone (Ryukyu Limestone) which is Pleistocene in geological age.

It is not deformed, but the odd anterior ambulacrum, the genital pores, the peripetalous fasciole, the subanal fasciole and the tubercles are obscure. It is believed that many fossil echinoids do not preserve their fascioles.

Fossils of this species has been known to occur in Farsan Island of Red Sea (Pliocene), Java (Upper Miocene), Daito-jima (Pleistocene).

This species is known living in Red Sea, Indian Ocean and Pacific Ocean.

Most probably this species lives in the depth of 1 m. under the tidal planes.

* Read Nov. 20, 1952; received Feb. 9, 1953

I wish to acknowledge my indebtedness to Professor Yoshikuni HIRAIWA and Assistant Professor Sadahiro MIYAKE of the Zoological Institute, Kyusyu University for their kind advices, and to Professor Jiro MAKIYAMA of the Geological and Mineralogical Institute, Kyoto University for revision of this description.

Description of Species

Family *Spatangidae* GRAY

Genus *Brissus* LESKE

Brissus latecarinatus LESKE

Plate 15, Figs. 1~6.

1855 *Brissus agassizii*, L. DÖDERLEIN, *Arch. f. Naturg., Jahrg. 51, Heft 1*, p. 108.

1900 *Brissus agassizii*, S. TOKUNAGA, *Zool. Mag., vol. 12*, p. 399, pl. 18, figs. 1-6.

1917 *Brissus latecarinatus*, H. L. CLARK, *Hawaiian Ech.*, p. 219.

1931 *Brissus agassizii*, H. OHSHIMA, *Zool. Mag., vol. 43, no. 516*, p. 601.

1933 *Brissus latecarinatus*, S. NISIYAMA, *Echinodermata*, p. 53.

1942 *Brissus latecarinatus*, S. NISIYAMA, *Jour. Ocean. Soc. Japan, 1*, p. 24, fig. 12.

1948 *Brissus* sp. indet. α, I. HAYASAKA, *Acta Geol. Taiwanica, vol.* 2, no. 2, p. 110, pl. 2, fig. 2.

Description:—The test is elongated oval, rounded at the anterior ambitus and pointed in the posterior margin. The greatest height and width are on the line between the marginal extremities of the posterior paired ambulacra. The interambulacrum V is elevated making a keel-like ridge. The abactinal side is generally elevated from the ambitus to the centre, but the actinal side flat. The anterior sulcus is wanting.

The apical system situates at anterior 1/3 of the longitudinal diameter. The genital pores are 4 and the posterior paired pores are larger than the anterior paired ones.

The anterior paired ambulacra forming an angle of about 160° one another, are shorter than the posterior ones (3/4), and almost straight but slightly concave anteriorly. The posterior paired ambulacra, forming an angle of about 25°, are concave outwards at the extremities. The odd anterior one is narrow, straight, and degenerate. The peripetalous fasciole is distinct, entering in each interambulacra (indistinct in fossil species.). The subanal fasciole is distinct too, situating under the periproct, concave at the middle of upper side and straight in under side (indistinct in fossil species.).

The peristome at anterior 1/6 of the actinal longitudinal diameter, forming a crescent shape.

The periproct is at the posterior margin of test, and oval-shaped.

The tubercles are irregular and smaller on the actinal side than on the abactinal (indistinct in fossil species).

Measurements:—

	Recent Species	Fossil Species
Longitudinal Diameter	100 mm.	109 mm.
Transverse Diameter	83 mm.	88 mm.
Height.	51 mm.	58 mm.
Ant. Paired Amb.;		
Length.	29 mm.	29 mm.
Width.	5.4 mm.	5.2 mm.
Post. Paired Amb.;		
Length.	37 mm.	35 mm.
Width.	4.2 mm.	5.0 mm.

Related Forms:—The relation with a Japanese species, *Brissus agassizii* DÖDERLEIN is not known. But according to DÖDERLEIN's original description both the species seem to be just alike. *Brissus* sp. α from Ryukyu Limestone of Taiwan by I. HAYASAKA is very much allied to the present species except for it's smaller size. *Brissus* sp. β of HAYASAKA from Kiko Formation (Upper Miocene) of Taiwan differs from this species in its smaller and wider anterior sulcus, the odd anterior ambulacrum being in shallow and in its wide depression, and smaller size.

Geological Horizon:—Ryukyu Limestone (Pleistocene), Recent.

Locality:—Ishigaki-jima, Ryukyu Islands.

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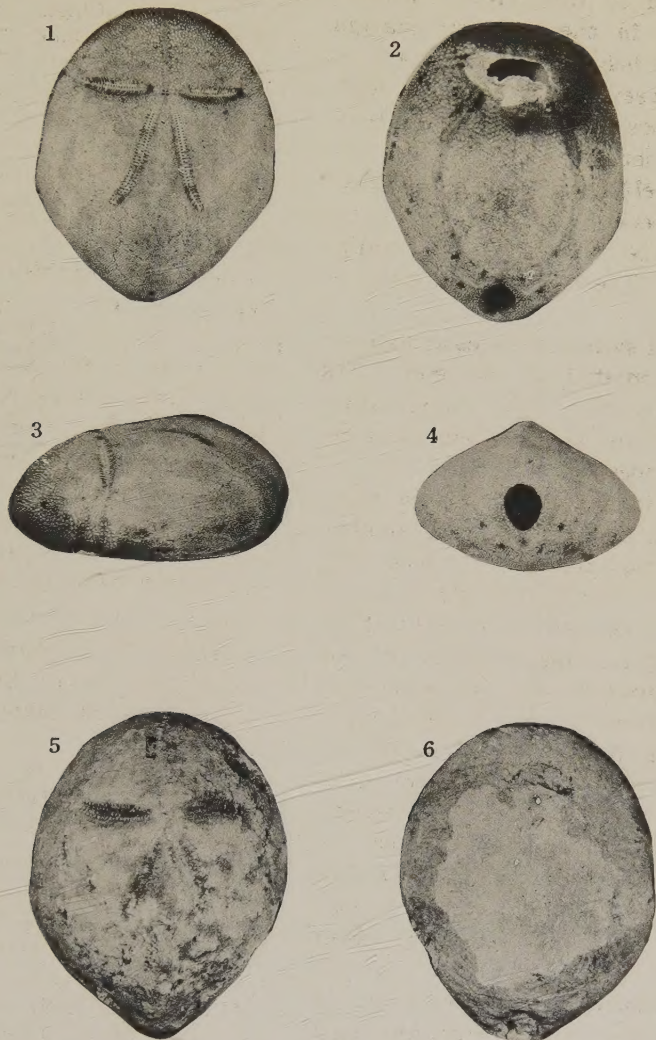

Explanation of Plate 15

Brissus latecarinatus LESKE

Fig. 1. Recent Species. Abactinal Side. ×2/5
Fig. 2. Recent Species. Actinal Side. ×2/5
Fig. 3. Recent Species. Lateral Side. ×2/5
Fig. 4. Recent Species. Posterior Side. ×2/5
Fig. 5. Fossil Species. Abactinal Side. ×2/5
Fig. 6. Fossil Species. Actinal Side. ×2/5

1954 年度・例会開催予定

	開催地	開催日	講演申込〆切日
第 57 回例会（済）	札　幌	2 月 13 日	1 月 31 日
第 58 回例会	仙　台	6 月 26 日	6 月 5 日
第 59 回例会	金　沢	10 月中旬	9 月 25 日
年　会	東　京	12 月下旬	11 月 30 日

講演御希望の方は本会宛御申込下さい

Announcement

Change in By-laws

On the occasion of the Annual Meeting of the Palaeontological Society of Japan, held on April 30, 1954, it was decided upon to revise Article 13 as indicated (in italic) below.

Article 13. Rates for annual dues shall be *600* Yen (Domestic) for regular members and *3* dollars for foreign members.

Addendum

According to the By-laws of the Society, for the fiscal year of 1954 (January to December), foreign members shall receive, besides the Journal, special papers as issued (postage included).

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